For the loss of 4.3 per cent in this analysis I can at present not account. Iron and copper eliminate themselves as chalcopyrite and pyrite; remain

Bi	=	19.35 : 210	=	0.0930	
Pb	=	45.87 : 206.4	=	0.2216	0.2878
Ag	=	9.98 : 215.3	=	0.0462	
S	=	13.37 : 32	=	0.4180	
R : Bi : S	=	3.09 : 1 : 4.5			

that is 6.18 $(PbAg_2)$ S + Bi_2S_3 = Beegerite.

The original beegerite, crystallized, from Clear Creek county, Colorado, contains no silver at all. Apparently this interesting species, only existing in one specimen heretofore, is not rare at the new locality, and may be procurable to collectors.

I reserve a more satisfactory examination to the future.

University of Pennsylvania, Jan., 1884.

The Remarkable Sun-glows in the Falls of 1883 and 1884.

By Wm. Blasius.

(*Read before the American Philosophical Society, January 16, 1885*).

There has been much speculation by scientists as to the true explanation of those extraordinary sun-glows that astonished the world in November of 1883, and reappeared in a somewhat lesser degree at about the same time in 1884. In the attempt to explain the brilliancy of this phenomenon, some few meteorologists started on that philosophical principle, that it differs from the usual sun-rises and sun-sets only in degree, and not in kind, and that an explanation must be found in the same laws that govern the ordinary phenomena, *i. e.*, in the refraction of the sun's rays in the stratum of moist air that surrounds the earth's surface.

These views found their difficulty in the fact that the atmosphere during the time the extraordinary phenomenon took place was comparatively dry, at any rate, that its moisture did not appear to reach to an altitude sufficiently elevated, to cause the glows to extend to that extraordinary height that they appeared to reach.

To overcome this difficulty, some meteorologists brought the mysterious cyclone into play. The cyclone whirls, so they say, the moist air to an elevation sufficiently high to account for the phenomenon. If the position of the cyclone were such as to allow the sun's rays to pass, in its highest region, through only one side of it; the highest portion of the sun-glows might find a satisfactory explanation; but as it would be difficult for the sun's rays to pass through both sides of the cyclone, the lower portion of the sun-glows seems to be left unaccounted for.

When meteorologists failed to satisfactorily solve the problem, the astronomers took the case in hand, and looked for an adequate cause ex-

traneous to the atmosphere. Prof. Young in Genf finds it in cosmic dust; Easterby ascribes the cause to chemical changes in the sun; others ascribe it to the influence of the aurora borealis or to the zodiacal light. Lockyer considered that the volcanic ashes thrown into the air by the eruptions of the Krakatoa, in August, 1883, is the true cause; but I suppose he has changed his views by this time, as the phenomenon reappeared in 1884 without the recurrence of any eruption.

I will not enter into a criticism of these different views, but the general impression is that the phenomenon remains as much a puzzle as ever. This is perhaps not surprising, for so long as meteorologists continue to hold to the old theory, that the movements and changes of the air in the Temperate zone are of a cyclonic nature, so long they will be unable to satisfactorily explain most meteorological phenomena, and the brilliant sun-glows only add another to the list of failures.

Seen from a standpoint I believe I have found by a study of nature to be the true one, meteorological phenomena appear to the observer in a natural undistorted state, and they are easily understood and explained. The sun-glows and the ordinary sunset brilliancies, are caused by the same forces, but under different meteorological conditions, which cannot be understood so readily, when seen from the standpoint of the old cyclonic theory. In the one, as well as in the other case, the color is produced by the refraction of the sun's rays in a stratum or sheet of moist air. The surrounding stratum of moist air is often observed, especially during the time the sun rises and sets; therefore, the phenomena on a small scale take place frequently. The more magnificent phenomenon can only take place when, in the progress of the equatorial air current northward, the warm, moist current comes between the observer and the rising or setting sun. There is then going forward a displacement of the cold, dry polar current or wave, by the moist warm equatorial current or wave, the latter slanting obliquely up and over the polar air. Where these currents meet they lie in the position of two wedges, the polar current having the thin edge of its wedge toward the south, on the surface. The warm, moist equatorial current has the thin end of its wedge or sphenoid up and above the cold current toward the north; its progress is generally indicated by cirrus clouds, which in the further progress, change into cirro-stratus. If the observer is now situated in the polar current, he will find the temperature low, the barometer high, and the air comparatively dry, the wind coming from a northerly direction. Between him and the rising or setting sun he would encounter, if he ascended in a balloon, the equatorial current, a body of moist warm air in the shape of a sphenoid, or wedge, or a prism. If there is a coincidence of the proper conditions, especially if the plane of meeting of the two currents has a tolerably steep inclination, the brilliant phenomenon as described will show itself.

For a more elaborate exposition of the relations of these equatorial and polar currents under such circumstances, I must refer to my work:

"Storms; their nature, classification and laws, with the means of predicting them." (Porter & Coates, publishers.) Especially to Plate vii, p. 76, where will be found diagrams representing the north-east storm in its progress, *i. e.*, the warm moist southern current replacing the cold, dry northern current.

Let us now examine how these views agree with the actual state of the atmosphere on October 26, 1884, when this phenomenon last appeared. To this end I copy the record from the United States Signal Service record:

	7 A. M.	11 A. M.	3 P. M.	7 P. M.	11 P. M.	3 A. M.
Barometer,	30597	30607	30560	30566	30556	30550
Temperature,	33.0	44	48.6	45.4	43.5	34.6
Dew point,	24.0	20	27.0	30.6	30.5	19.6
Humid.,	68	37	46	56	60	53
Dir. of wind,	N.	N.	S.	S.E.	S.E.	N.
Clouds,	0	0	0	Cir. Cum.	0	0
	Clear.	Clear.	Clear.	Cloudy.	Clear.	Clear.

From this we see that the meteorological conditions of the atmosphere coincided favorably to show the phenomena in question to an observer in Philadelphia. High barometer, low temperature, clear weather, northerly wind. At 3 P. M. the wind came from the south, then the temperature rose, the pressure decreased, and toward 7 P. M. Cir. Cum. appeared, indicating that the equatorial warm moist air, flowed obliquely over the polar current, and that it took a position between the observer in Philadelphia and the setting sun, and that the sun's rays of necessity went through the sphenoid or prism of the body of moist warm air, and so produced the brilliancy as described. Prof. Clement Hess,* from Frauenfeld, describes similar conditions in the atmosphere when the phenomenon took place in November 3, 1883, at his place of observation. The day preceding, all Europe was under high pressure, then came cirrus and cirrostratus, with low pressure in their rear traveling eastward. Prof. Hess considers this low pressure a forward moving cyclone. Seen from my standpoint, it is the equatorial current lying in the form of a sphenoid above the polar current. The sun's position in relation to the inclination of the plane of meeting or the gradient, is evidently of much importance, and if we had all the facts, the result would be mathematically determined.

If now it is asked why the brilliant sun-glows should not be observed every autumn, I think the answer is that it but infrequently happens that at this season of the year, when the sun is in position to produce this effect, the equatorial current reaches to sufficiently high altitudes. And, it will be remembered, that both in 1883 and to a less degree in 1884, the approach of winter was exceptionally late, the equatorial current remaining much longer than usual in its summer position.

* Zeitschrift der Ostreichischen Gesellschaft für Meteorologie, xviii Band, p. 20.